PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G01G 19/58, 17/04, F17C 13/02, A45C 13/28 — A1

(11) International Publication Number: **WO 98/59223**

(43) International Publication Date: 30 December 1998 (30.12.98)

(21) International Application Number: PCT/ZW98/00007

(22) International Filing Date: 23 June 1998 (23.06.98)

(30) Priority Data:

97/5614	25 June 1997 (25.06.97)	ZA
97/11633	29 December 1997 (29.12.97)	ZA

(71)(72) Applicants and Inventors: BRIGHTON, Barry, David [ZW/ZW]; Throgmorton House, 51 Samora Machel Avenue, Harare (ZW). VON SEIDEL, Michael [ZA/ZA]; 5 Romajador Avenue, Sandhurst Extension 4, Sandton, Gauteng Province (ZA).

(74) Agents: ROSETTENSTEIN, Jennifer, Jane et al.; Honey & Blanckenberg, P.O. Box 85, Harare (ZW).

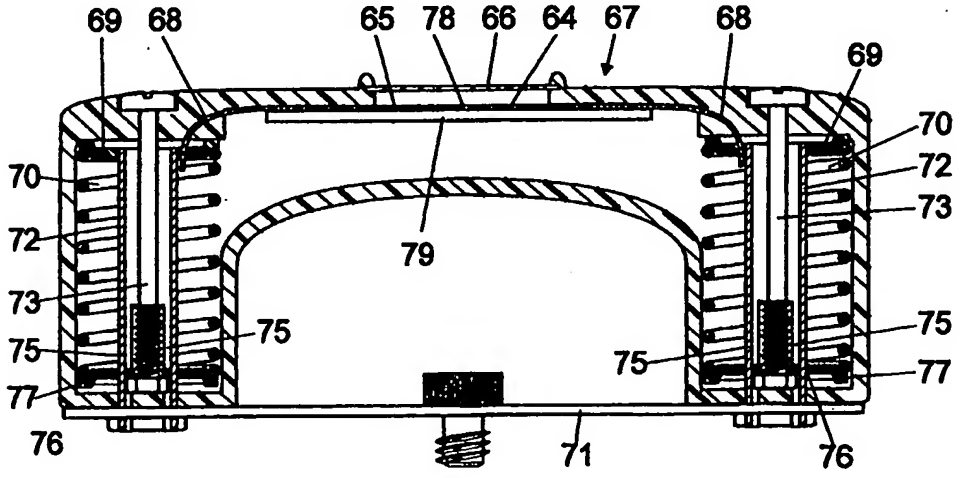
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published

With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: GAS CONTENT SCALE FOR PORTABLE GAS CYLINDERS



(57) Abstract

A handheld gas content scale (1) for indicating the remaining weight of gas, such as low pressure gas, in a portable size of gas cylinder (10). The scale comprises a body defining an operatively approximately horizontal handle (2, 25, 37, 67, 95); at least one object support member (4, 28, 45, 73, 84, 98, 105) adapted for engagement with a gas cylinder; a weight activated mechanism (13, 23, 36, 70, 94, 108) at least partly housed in the body and adapted to be stressed by the weight of a gas cylinder supported by the object support member when the latter is supported by the handle; and indicator means (16, 30, 62, 64 and 65, 93, 99, 111) located in an operatively upper region of the handle defining body and directed upwardly for visibility from above. Means (15, 26, 39, 73, 104) are provided for zeroing the indicator means to reflect a "zero" weight when an empty gas cylinder is supported by the scale.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

GAS CONTENT SCALE FOR PORTABLE GAS CYLINDERS

FIELD OF THE INVENTION

This invention relates to a gas content scale for portable gas cylinders, in particular, but not exclusively, low pressure gas (LPG) cylinders typically having a gas content of up to about 9.0kg (20lbs) and possibly somewhat more, when full.

Whilst being primarily directed at spring-based scales, the invention also extends to electronic scales for example utilizing strain gauge technology for measuring weight.

BACKGROUND TO THE INVENTION

It is an ongoing problem to monitor the amount of gas remaining in a portable low pressure gas (LPG) cylinder after part of its contents has been consumed. It can easily happen that the gas runs out suddenly and a refuelling depot is not available.

Consequently, it is quite commonplace to refill a gas cylinder somewhat arbitrarily. This can result in excess wastage consequent on venting the cylinder to atmosphere as part of the refilling procedure.

The only practical determination of the gas content of such a cylinder is that of weight and various attempts have been made to provide a suitable content scale for gas cylinders.

Thus French Patent No. 2 282 102 describes a simple scale having a platform supported on a base through compression springs and itself supporting the bottom of a gas cylinder. The position of the platform relative to the base which is an indication of the weight of the cylinder is viewed through a window in a skirt to the platform . This arrangement is difficult to implement practically and also, it is extremely difficult to view the window with the base on the ground and the window upright.

German Patent No. DE 4 120 186 describes a similar arrangement, but wherein the downward movement of the platform is utilised to activate a plunger in a cylinder communicating with a transparent upright viewing tube. This arrangement is also difficult to implement practically and its construction is sensitive to damage.

United States Patent No. 5 555 764 describes a similar device but wherein a circular pressure gauge is provided in the skirt to the platform and the springs are omitted as only pressure generated in a fluid is detected. This device has the same disadvantages as the French device in that viewing of the gauge is extremely difficult and the device, being of a platform-type, is cumbersome.

British Patent No. 2 284 269 and South African Patent No. 81/5455 describe devices which detect the weight at only one radial position at the edge of a gas cylinder. These devices are dependant upon the inclination of the cylinder to the horizontal and thus on the fact that the supporting floor is horizontal; and are in any event inappropriate to a portable size of gas cylinder.

One solution to the problem which is exercised by some gas suppliers is simply to weigh a customer's gas cylinder and deduct the empty or "TARE" weight which is generally imprinted on the cylinder. Whilst being effective, this is not convenient for persons who must travel reasonable distances to their gas supplier. Also, this method is hardly ever, if at all, practised by private individuals for whatever reason, which may be lack of knowledge, lack of confidence, or the absence of a suitable scale.

Gas suppliers when practising this method may use any suitable scale and, not uncommonly, use a portable spring scale which is usually suspended from a wall, ceiling or the like. Spring scales described in the literature and which could be used in carrying out this method all measure total weight of the article being weighed and are, for example, described in German Patent No's 3 628 148 and 2 918 436 as well as Swiss Patent No. 667 920. Other proposals of hand held scales of which applicant is aware, but which as far as can be determined have not been manufactured, are those of German Offlegungschrift 20 60 208, and US Patents 2 710 083 and 2 759 577, all of

which describe spring scales embodied in handles especially in relation to the weighing of an item of luggage to gauge compliance with airline limits.

OBJECT OF THE INVENTION

It is the object of this invention is to provide a compact and "comfortable-to-hold" gas content scale for indicating at least the approximate extent of gas remaining in a portable gas cylinder such as an LPG cylinder without the physical discomfort of raising the scale, together with a cylinder to eye level.

SUMMARY OF THE INVENTION

In accordance with this invention there is provided a gas content scale comprising a body at least a part of which defines an operatively approximately horizontal handle; at least one object support member supported by the body by way of a weight activated mechanism adapted to be stressed by an object supported by the handle; and indicator means orientated for visibility from above and coupled to said weight activated mechanism to indicate at least an approximate weight of the object within a predetermined range of weights, the scale being characterised in that the object support member has attachment means for attaching it to a gas cylinder constituting said object and in that compensation means are included to compensate for the weight of an empty gas cylinder and provide the indicator means with a full indication range extending from substantially zero indication corresponding to an empty gas cylinder supported by the object support member to a substantially full indication corresponding to a substantially full gas cylinder supported by the object support member.

Further features of the invention provide for the object support member to be movable relative to the body against resistance of the weight activated mechanism which assumes the form of at least one resiliently deformable member at least partly housed within the body; and for the weight activated mechanism to be selected from the group consisting of a centrally positioned compression spring or coaxial springs; a torsion spring; an arcuate leaf spring; and in particular a pair of parallel compression springs symmetrically spaced about the centre of the handle in which case the compression springs may be located outside the extent of the handle defining part of the body.

Still further features of the invention provide for the object support member to be defined by two spaced operatively downwardly extending limbs each independently supported directly or indirectly by the body through its own associated compression spring with the weight activated mechanism coupled to the indicator means through a movement transfer mechanism adapted to effectively add and transfer movement of the two object support limbs; and for the movement transfer mechanism to comprise two longitudinally and oppositely movable rigidly flexible display strips which co-operate at co-operating end regions in a central region of the handle in which they are directed upwardly, the strips each passing through a right angled bend and being connected to move in unison one with each of the object support member limbs to translate vertical movement of the two spaced support member limbs into substantially horizontal movement of the co-operating end regions of the display strips which are visible from above and are adapted to constitute the indicator means.

Alternative features of the invention provide for the object support member to have two operatively downwardly extending limbs interconnected inside the handle by a transverse limb and a movement transfer mechanism interposed between the weight activated mechanism and the indicator means and located roughly centrally in the length of the transverse limb so as to amplify the movement of the support member or limbs thereof relative to the body; for the movement transfer mechanism to be selected from the group consisting of one based on a rack and pinion type mechanism , a cam and cam follower type of arrangement, and a twisted spindle and cooperating sleeve or aperture, in each of which cases the indicator means is conveniently a needle or other indicator rotatable about a pivot and visible against a graduated or otherwise marked background; or for the movement transfer mechanism to comprise two longitudinally and oppositely movable rigidly flexible display strips substantially as defined above.

In the case of springs the invention further provides for each spring to be accommodated in the handle defining body in a pre-stressed condition corresponding approximately to the stress which would be exerted thereon by an empty gas cylinder such pre-stress constituting said compensation means; for one extremity of each spring to be supported by the handle defining body

through a screw threaded adjustment member for adjusting the zero position of the indicator means; and in the case of a pair of spaced compression springs for each screw threaded adjustment member to be an axially extending screw threaded member supporting the operatively lower end of the associated spring and preferably extending downwardly from the top of the body to a retainer at the lower end of the associated spring so as to support the lower end of the spring in adjustable manner.

In the case of the weight activated mechanism being electronic the scale includes a stress member interconnecting the handle and the object support member and having a strain gauge or the like associated therewith together with electronic circuitry, a power supply battery receptacle and indicator means in the form of an electronic ammeter, a volt meter, or even an LCD (liquid crystal display) readable from the top of the handle and graduated or otherwise marked to indicate at least approximate extent of weight.

The indicator means may be either located centrally or offset beyond the handle part of the body and towards one end thereof.

Still further features of the invention provide for the attachment means to be selected from the group consisting of a screw threaded sleeve or plug for engaging an internally screw threaded gas outlet connection of a gas cylinder; a pair of coaxial inwardly directed fasteners for engagement with outwardly directed sockets or recesses for securing a handle to the gas cylinder; one, or preferably a pair, of laterally spaced hooks preferably having retaining catches; and a universal attachment accessory which itself is adapted to be clamped to a part of a gas cylinder; and for the entire weight sensitive means to be housed within the body.

In order that the invention may be more fully understood, various embodiments thereof will now be described with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:-

FIG.1 is a schematic part-sectional elevation of one form of gas content scale with the indicator means illustrated in a "zero" position corresponding to supporting an empty gas cylinder;

FIG.2 is a similar view, but showing the indicator and spring in a condition corresponding to supporting a full gas cylinder;

FIG.3 is a plan view of the scale illustrating the indicator means in a position corresponding to a half-full condition of a gas cylinder;

FIG.4 is an enlarged cross-sectional view taken roughly along line IV to IV in Fig 1 with the indicator means as shown in Fig 3;

FIG.5 illustrates similarly to Fig 1 alternative spring means, movement transfer mechanism, and gas cylinder attachment means;

FIG.6 is an end view of the scale illustrated in Fig 5;

FIG 7 is a plan view of the scale illustrated in Fig 5;

FIG 8 illustrates similarly to Fig 1 a further alternative spring means, indicator means, and gas cylinder attachment means;

FIG 9 is a plan view of the scale illustrated in Fig 8;

FIG 10 is an elevation similar to Fig 8 but illustrating a further alternative movement transfer mechanism and combination indicator means;

FIG 11a is a plan view of the scale illustrated in Fig 10 showing the indicator means in a position corresponding to the "empty" condition of the gauge;

FIGS 11b & 11c illustrate the indicator of Fig 11a but corresponding to a "half-full" and "full" condition respectively;

FIG's 12 & 13 each illustrate further movement transfer and amplification means with Figure 13 also illustrating alternative spring means;

FIG.14 is an elevation similar to Fig1 but illustrating an electronic form of scale;

FIG.15 is a plan view thereof;

FIG.16 illustrates in plan view an alternative location for the indicator means;

FIG 17 is an isometric view of a universal attachment accessory;

FIG 18 is a side view thereof;

FIG 19 is a front view thereof, and;

FIG.20 illustrates a gas cylinder fitted with a scale of this invention.

DETAILED DESCRIPTION WITH REFERENCE TO THE DRAWINGS:

Turning now to the embodiment of the invention illustrated in Figures 1 to 4, one form of gas content scale, generally indicated by numeral (1) assumes the form of a mildly arcuate, hollow plastics body defining a handle (2) made in two lateral halves joined along a centre line (3) (see Figs 3 and 4) to form a housing for the weight activated and movement transfer mechanisms, and indicator means described below.

An object support member (4) assumes the form of a basically rectangular metal member having, operatively uppermost, a transverse limb (5) of arcuate shape to conform roughly with the shape of the handle. Two parallel limbs (6) which communicate with each end of the transverse limb (5) pass operatively downwardly out of the end regions of the body and are directed

inwardly at their lower ends to terminate in attachment means in the form of a pair of spaced coaxial screws (7) chosen to fit into sockets (8) in the neck region (9) of an LPG cylinder (10) (see Fig 20).

The transverse limb (5) is thus free to move up and down inside the handle between two terminal positions defined by upper stops (11) and lower stops (12) conveniently formed integral with the handle. Figure 1 illustrates the support member (4) in its uppermost position bearing against the upper stops (11) and Figure 2 illustrates it in its lowermost position bearing against the lower stops (12).

An arcuate leaf spring (13) which forms the weight activated mechanism in this embodiment of the invention, extends along a substantial part of the length of the handle; is centrally located; and urges the centre of the transverse limb (5) of the support member upwardly towards engagement with the upper stops (11). The one end (14) of the leaf spring is supported by the handle through an adjustment screw (15) to enable the gas content scale to be zeroed, which it is envisaged may be necessary consequent upon manufacturing tolerances of the springs and gas cylinders. In any event the spring must be stressed in order that it be introduced into the available space and the degree of stress is approximately sufficient to ensure that the support member is held against the uppermost stops, or at least immediately adjacent the stops when an empty gas cylinder is supported by it. This arrangement constitutes the compensation means required.

It will be understood that the support member moves from its upper terminal position (Figure 1) to its lower terminal position (Figure 2) under the influence of increased weight of the actual gas in a gas cylinder. The degree of such movement is reflected on an indicator needle (16) visible through an arcuate window (17) in the top surface of the handle with the needle extending transversely across the central region of the handle in front of a backing plate (18) carrying graduations or other indicia as shown in Figure 3 which simply indicates the two extremities of "empty" or "full". It may also indicate the standard weight of gas that particular size of cylinder is to contain, a matter that is further discussed below.

The needle is rotatable about the axis of a pivot (19) located centrally on the length of the handle and laterally offset from the spring and towards the bottom of the interior of the handle. The movement transfer and amplification mechanism in this case is composed of a cam plate (20) pivotally mounted to the central lower part of the inside of the handle by said pivot (19). The cam plate has an arcuate cam slot (21) extending roughly upwardly, but laterally outwardly. The slot (21) receives a cam follower in the form of a pin (22) movable in unison with the centre of the transverse limb (5) of the support member. The indicator needle (16) is secured to, and moves in unison with, the cam plate (20).

The slot (21) is shaped such that, as the transverse limb (5) of the support member (4) (and thus the pin (22)) move from a position in which it engages the upper stops (11), to one in which it engages the lower stops (12), the cam plate and thus the indicator needle (16) rotate from the "empty" to the "full" positions.

In order to use the scale in as accurate a manner as possible with particular emphasis on the indication of an empty condition of a cylinder, the empty gas cylinder should be supported on the support member and the "zero" mechanism (15) operated until the needle is just about to move from its "empty" position in which the transverse limb engages the uppermost stops (11). The spring is designed and made such that with the same gas cylinder in a full condition, substantially full deflection of the needle is achieved. It is, however, considered that it will be irrelevant if the full condition is not exactly reflected and any error in manufacture of the spring can best be accommodated at this end of the indicator means rather than at the "empty" end.

It will be appreciated that each standard size or capacity of gas cylinder will require its own custom designed spring in order that the performance described above be achieved. The same body may, however, be made to accommodate a range of different sizes. This particular embodiment will probably be appropriate to smaller sizes of cylinders, say having a capacity of up to about 4.5 Kg (10 lbs).

In the embodiment of the invention illustrated in Figs 5, 6 and 7, the leaf spring is replaced by a pair of spaced helical compression springs (23) one of which is located on each side of a central handle defining part (24) of the hollow body (25). This arrangement enables relatively long springs to be employed without increasing the height of the handle itself. The adjustment means in this case are an adjustment screw (26) at the lower end of each spring although the springs still have to be compressed in order to be accommodated in their positions, this constituting the compensation means defined above.

This embodiment of the invention also employs a different movement transfer and amplification means constituted basically by a rotatable spindle (27) having a non-circular, conveniently square, shape in cross-section. The spindle axis extends at right angles to the direction of movement of the transverse limb (28) of the support member and the spindle itself passes through a complementary sleeve or aperture (29) movable in unison with this limb. Thus, as the support member moves up and down the spindle rotates which causes rotation of a needle (30) fixed to the upper end of the spindle. The needle is visible through a window (31) in the top of the body.

In this embodiment of the invention the lower ends (32) of the parallel limbs (33) of the support member are bent inwardly and downwardly to provide attachment means in the form of two hooks (34) laterally spaced by a distance such that they can be engaged with a permanent metal rod-type of handle found on many different types of gas cylinders. Retaining catches (35) ensure that the gas content scale will remain in association with such a handle until manually released.

Figures 8 and 9 illustrate a still further embodiment of the invention in which, in order to cater for heavier gas cylinders, the compression springs (36) are made to a substantially larger diameter than those (23) illustrated in Fig 5 and, as illustrated in plan view in Fig 9, these springs can be accomodated in two cylindrical compartments (38) in the body of larger diameter than the width of the handle (37) itself.

In this case the adjustment means for adjusting the zero position comprise, in respect of each spring, an axially extending grub screw (39) extending downwardly from the top (40) of the body with the head (41) appropriately recessed as illustrated. The screw threaded lower end (42) of each grub screw cooperates with a nut (43) cooperating in turn with a retainer plate (44) engaging and supporting the operatively lower end of the associated spring (36). Rotation of the grub screw therefore will compress or release the tension on the spring to some extent to adjust the zero position which, as described above, balances the empty weight of an appropriate gas cylinder. Clearly the two grub screws should be adjusted by roughly the same amount for best results.

In this case, the springs are large enough to accommodate object support limbs (45) in the form of elongate pins extending parallel to, but offset from, the grub screws (39) but still within the confines of the associated spring. Each of these pins has a head (46) at its upper end engaging one end region (47) of a transverse limb (48) of the object support member, and the centre of which activates the movement transfer and amplifying mechanism.

Axial movement downwardly of each of the pins will cause compression of the associated spring against the upward force of the adjustment grub screw. The lower ends of the pins pass out of the handle unit and through opposite extremities of a laterally extending object support attachment assembly (49). The latter comprises a central stirrup (50) attached by means of a pair of spaced coaxial pivots (51) to two connecting brackets (52) attached to the lower ends of the pins (45). The stirrup has a central screw (53) for attachment, directly or indirectly, to a gas cylinder. Thus the weight of a gas cylinder and any contents thereof will transfer substantially equally to the two springs when it is suspended by means of the handle defining body.
In this embodiment of the invention the movement transfer mechanism can be made to amplify movement and comprises a slot (54) and cam follower pin (55) similar to that described with reference to Figs 1 to 4 but with the slot being provided in a cam plate (56) having gear teeth (57) formed in the manner of a quadrant at its periphery and on an arc having a centre coincident with the pivotal mounting (58) of the cam plate. The teeth engage a rack (59) which is freely movable in a flat plane along guides (60) adjacent a

window (61) in the top of the handle unit with a needle (62) moving in unison therewith to indicate the position of the rack and therefore the gas content of a cylinder. The background (63) to the indicator has two overlapping oppositely tapering zones (63a) and (63b), one (63a) of red associated with the empty condition, and the other (63b) of green associated with the full condition.

Figure 10 illustrates a substantially similar arrangement but wherein the movement transfer means is extremely simple and assumes the form of two oppositely extending rigidly flexible strips (64) and (65) confined to sliding movement in a substantially horizontal plane beneath a centrally positioned, upwardly directed window (66) in the handle body (67). The strips each pass through a right angle bend in their end regions remote from the window as indicated by numeral (68) and are attached directly to a terminal disc (69) engaging the upper end of its associated spring (70). Each disc (69) is attached to a common transverse object support attachment member (71) at the bottom of the body.

The link member of Fig 8 is omitted entirely and, because of this, the offset support limbs or pins (45) are replaced by an arrangement symmetrical about the axis of its associated spring. In this case a tubular limb (72) receives therein the associated adjustment screw (73) and nut (74). The lower end region of each tubular limb is slotted to form two symmetrical sub-limbs (75) which pass through complementary slots (76) in the associated retainer plate (77) at the lower end of the spring. Thus, the upper terminal disc is, in use, pulled downwardly by the tubular limb whilst adjustment of the compression in the spring in the zero condition is available as described above. As each terminal disc moves downwardly it pulls its strip (64) or (65) with it.

Each strip (64) (65) has its free end (78) positioned substantially exactly in the centre of the length of the window to almost abut each other when an empty gas cylinder is suspended on the object support attachment member (71), (the zero position).

The strips are located above a backing member (79), at least the upper surface of which is coloured green whereas the strips themselves are col-

oured red. The zero condition is illustrated in Fig 11a in which only the red colour of the strips is visible. In Fig 11b the window is illustrated in a position corresponding to that in which the additional weight of a half full gas cylinder is supported by the scale. In this condition about the central half of the window will display the green colour of the backing member as shown by numeral (82). In the condition corresponding to a full gas cylinder the entire window will show the green colour of the backing member; see Fig 11c.

It will be understood that with this arrangement there is no movement amplification but a simple addition of the movement of the compression of the two springs. In this regard it is considered that about 12 to 15 millimetres (0.5 to 0.6 inch) compression of the springs between the empty and full conditions will be adequate, thus giving an useful length of window of about 24 to 30 mm (1.0 to 1.2 inch).

Figure 12 illustrates a further alternative to the movement transfer and amplification means in which a rack (83) movable vertically with a support member (84) engages a pinion gear (85) which rotates in unison with a small drum (86) of substantially larger diameter to give the required movement amplification. A flexible cord (87) has both of its ends wound around the drum in the same direction so that rotation of the drum causes linear movement of a laterally offset zone (88) of the cord located above a backing plate (89) and beneath a window (90) in the top of the handle (91). Two spaced freely rotatable rollers (92) guide the effectively endless cord to form the zone (88) and to be guided back onto the drum (86). A needle (93) is attached to the cord so as to move from one end of the window to the other for the purposes of indicating the deflection.

Figure 13, illustrates some further variations within the scope of the invention and, in particular, in this case, a torsion spring (94) is positioned at one end of the handle (95) which comprises an upper and a lower half (96) and (97) pivotally attached to each other at this end coaxial with the spring. The lower half (97) is arranged to move into the upper half (96) when weight is exerted on the support members (98) carried by the upper half. In this case the indicator means is once more a needle (99) carried on a cord (100) wound around a lightly spring loaded drum (101) located at one end of the

window (102). Beyond the other end of the window the cord passes in roughly zigzag manner around a series of rollers (103) each alternate one of which is connected to the upper or lower handle member (96) or (97) so as to provide a movement magnification as the lower handle portion (97) movers into the upper handle half and its associated rollers (103a) move in between the rollers (103b) fixed relative to the upper handle half (56). The number of passes of cord around these rollers will determine the amplification and an adjustment roller (104) can be provided at the ultimate end of the series to adjust the zero position of the needle (99).

Figs 14 and 15 illustrate an electronic version of the in which the object support member (105) is supported through a fairly rigid inclined (or alternatively U-shaped) leaf (106) by the handle defining body (107) with a strain gauge (108) being secured to the leaf. The strain gauge is connected to conventional weight determining circuitry (109) powered by a replaceable battery (110) held in a power supply battery receptacle. The indicator means in this case assumes the form of an ammeter or volt meter (111) located centrally in the top of the handle. All the components are located fully within the handle and electronic zeroing means can be provided for, in particular, in the case of a gas content scale, for zeroing the indicator to show "zero" when an empty gas cylinder is supported by the support member. Power saving circuitry may be incorporated to switch the circuitry on only when the handle is lifted.

It is not essential that the indicator in any of the above cases be located in the central region of the handle and, as shown in Figure 16, the indicator means (112) could be located at one end of the handle (113).

In order to facilitate, in appropriate cases, the attachment of an object support member of the type illustrated in Figs 8 and 10 to a gas cylinder more universal, an accessory of the nature illustrated in Figs 17 to 19 may be employed. This accessory, generally indicated by numeral (114), is of basically inverted channel shape with a screw threaded socket (115) in the web for attachment to the central attachment screw (53) in Fig 8 or the equivalent illustrated in Fig 10. The one downwardly extending flange (116) receives a clamping screw (117) passing through it at right angles so that it

can be used to clamp an existing handle or other part of a gas cylinder against the opposite flange. The latter is bifurcated to define two fingers (118) which are preferably inclined inwardly so as to assist in clamping a handle or rib of a gas cylinder therein.

Clearly, numerous variations may be made to the embodiments of the invention described above without departing from the scope of the invention. In order to provide for different capacity gas cylinders with a single body size and shape of handle defining body it need only be made to accommodate different springs for each different size of cylinder. The gas scale would in such a case be marked clearly, or colour coded to indicate the size of gas cylinder with which it is to be used. It is also within the scope of the invention that a relatively light weight gas fitting such as a gas lamp or cooking ring can be permanently associated with a gas cylinder and that the weight of such gas equipment can be compensated for by additional stressing of the springs in the zero condition. In this instance the method of attachment of the scale to the cylinder would have to be appropriate.

CLAIMS:-

1. A gas content scale (1) comprising a body at least a part of which defines an operatively approximately horizontal handle (2) (25) (37) (67) (95); at least one object support member (4) (28) (45) (73) (84) (98) (105) supported by the body by way of a weight activated mechanism (13) (23) (36) (70) (94) (108) adapted to be stressed by an object supported by the handle; and indicator means (16) (30) (62) (64) and (65) (93) (99) (111) orientated for visibility from above and coupled to said weight activated mechanism to indicate at least an approximate weight of the object within a predetermined range of weights, the scale being characterised in that the object support member has attachment means (7) (34) (53) (98) for attaching it to a gas cylinder (10) constituting said object and in that compensation means are included to compensate for the weight of an empty gas cylinder and provide the indicator means with a full indication range extending from substantially zero indication corresponding to an empty gas cylinder supported by the object support member to a substantially full indication corresponding to a substantially full gas cylinder supported by the object support member.

2. A gas content scale as claimed in claim 1 in which the object support member is movable relative to the body against resistance of the weight activated mechanism which assumes the form of at least one resiliently deformable member at least partly housed within the body.

3. A gas content scale as claimed in claim 2 in which the weight activated mechanism is selected from the group consisting of a centrally positioned compression spring or coaxial springs; a pair of spaced compression springs (23) (36) (70) symmetrically arranged about the centre of the handle; a torsion spring (94); and, an arcuate leaf spring (13).

4. A gas content scale as claimed in claim 3 in which the weight activated mechanism comprises a pair of parallel compression springs (23) (36) (70) symmetrically spaced about the centre of the handle.

5. A gas content scale as claimed in claim 4 in which the compression springs are located one on each side of, and outside the extent of, the handle part of the handle defining body.

6. A gas content scale as claimed in either of claims 4 or 5 in which the object support member is defined by two operatively downwardly extending limbs (72) each independently supported directly or indirectly by the body through its own associated compression spring (70) and the weight activated mechanism is coupled to the indicator means through a movement transfer mechanism adapted to effectively add and transfer movement of the two object support limbs.

7. A gas content scale as claimed in claim 6 in which the movement transfer mechanism comprises two longitudinally and oppositely movable rigidly flexible display strips (64 & 65) which abut or overlap at co-operating end regions in a central region of the handle in which they are directed upwardly, the strips each passing through a right angled bend and being connected to move in unison one with each of the object support member limbs (72) to translate vertical movement of the two spaced support member limbs into substantially horizontal movement of the co-operating end regions of the display strips which are visible from above and are adapted to constitute the indicator means.

8. A gas content scale as claimed in any one of claims 2 to 5 in which the object support member has two operatively downwardly extending limbs (6) (33) (45) (105) interconnected inside the handle by a transverse limb (5) (28) (48) and a movement transfer mechanism (20) (27) (56) (64 & 65)(85 & 86) (103) interposed between the weight activated mechanism and the indicator means and located roughly centrally in the length of the transverse limb is adapted to amplify the movement of the support member or limbs thereof relative to the body.

9. A gas content scale as claimed in claim 8 in which the movement transfer mechanism is selected from the group consisting of one based on a rack and pinion type mechanism (83 & 85), a cam and cam follower type of arrangement (21 & 22) (56 & 59), or a twisted spindle and coop-

erating sleeve or aperture (27 & 29), in each of which cases the indicator means is conveniently a needle (16) (30) (62) (93) or other indicator rotatable about a pivot and visible against a graduated or otherwise marked background.

10. A gas content scale as claimed in any one of claims 2 to 5 in which the object support member has two spaced operatively downwardly extending limbs (6) (33) (45) (105) interconnected inside the handle by a transverse limb (5) (28) (48) and a movement transfer mechanism comprising two longitudinally and oppositely movable rigidly flexible display strips which abut or overlap at co-operating end regions in a central region of the handle in which they are directed upwardly, the strips each passing through a right angled bend and being connected to move in unison one with each of the limbs to translate vertical movement of the two spaced support member limbs into substantially horizontal movement of the co-operating end regions of the display strips which are visible from above and are adapted to constitute the indicator means.

11. A gas content scale as claimed in any one of claims 3 to 10 in which each spring is accommodated in the handle defining body in a pre-stressed condition corresponding approximately to the stress which would be exerted thereon by an empty gas cylinder such pre-stress constituting said compensation means.

12. A gas content scale as claimed in claim 11 in which one extremity of each spring is supported by the handle defining body through a screw threaded adjustment member (15) (26) (39) (73) for adjusting the zero position of the indicator means and which define said compensation means.

13. A gas content scale as claimed in claim 12 in which the spring based means is a pair of spaced compression springs (23) (36) (70) and each screw threaded adjustment member (26) (39) (73) is an axially extending screw threaded member supporting the operatively lower end of the associated spring.

14. A gas content scale as claimed in claim 13 in which each screw threaded member (39) (70) extends downwardly from the top of the body to a retainer plate (44) (77) at the lower end of the associated spring so as to support the lower end of the spring in adjustable manner.

15. A gas content scale as claimed in claim 1 in which the weight activated mechanism is electronic and includes a stress member (106) interconnecting the handle (107) and the object support member (105) and having a strain gauge (108) associated therewith; together with electronic circuitry (109), a power supply battery (110) receptacle and indicator means in the form of one of the group consisting of an electronic ammeter, a volt meter, or even an LCD (liquid crystal display) (111) readable from the top of the handle and graduated or otherwise marked to indicate at least approximate weight.

16. A gas content scale as claimed in any one of the preceding claims in which the indicator means is either located centrally or offset (112) beyond the handle part of the body and towards one end thereof.

17. A gas content scale as claimed in any one of the preceding claims in which the attachment means are selected from the group consisting of a screw threaded sleeve or plug (53) for engaging an internally screw threaded gas outlet connection of a gas cylinder; a pair of laterally inwardly directed screws (7) for engagement with a pair of sockets or recesses in the neck of a gas cylinder; one, or preferably a pair, of laterally spaced hooks (34) preferably having retaining catches (35); and, a universal attachment accessory (114) which itself is adapted to be clamped to a part of a gas cylinder.

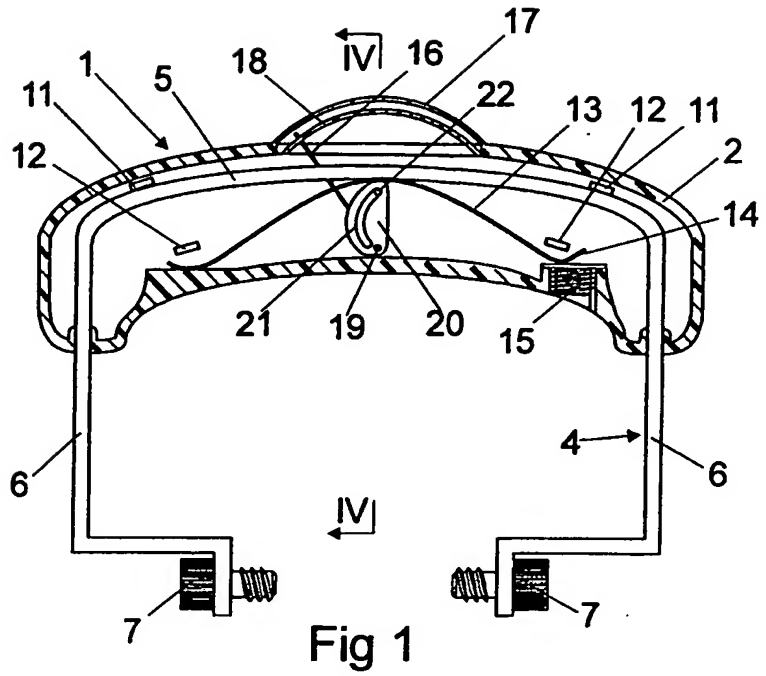


Fig 1

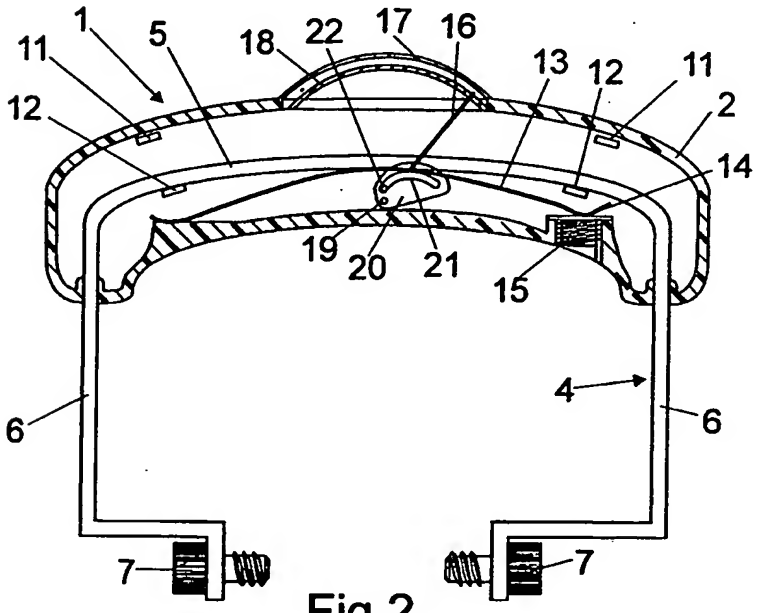


Fig 2

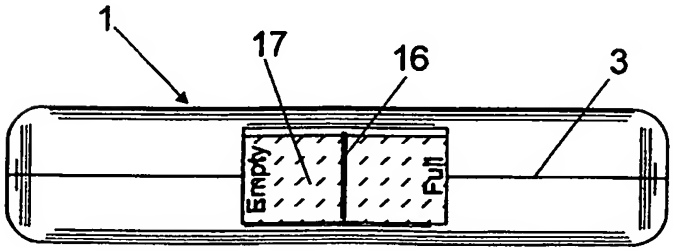


Fig 3

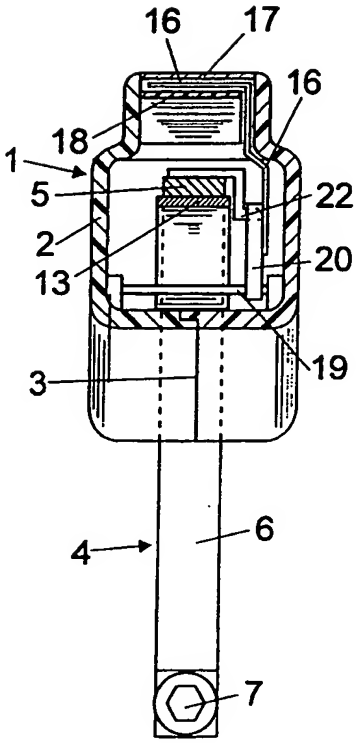


Fig 4

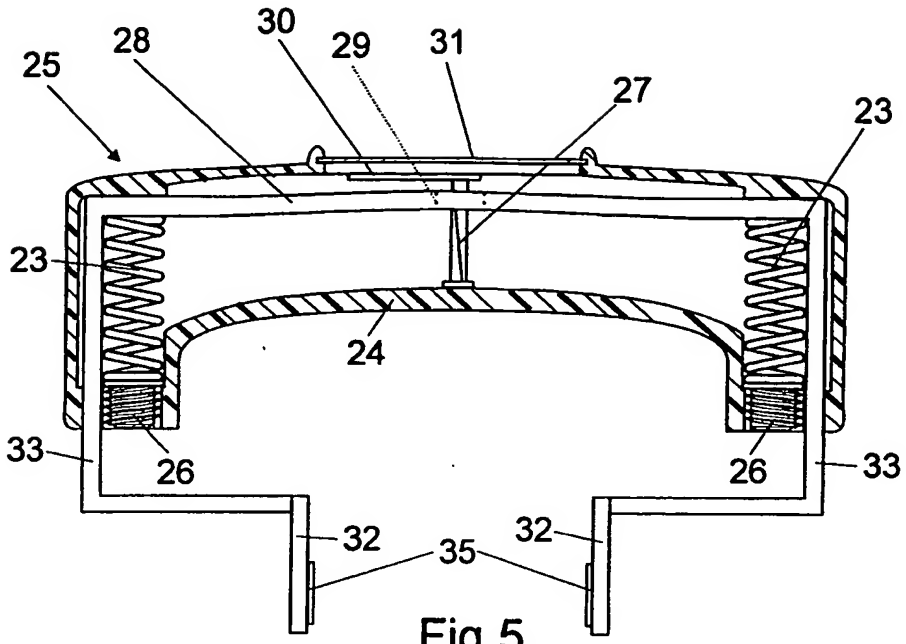


Fig 5

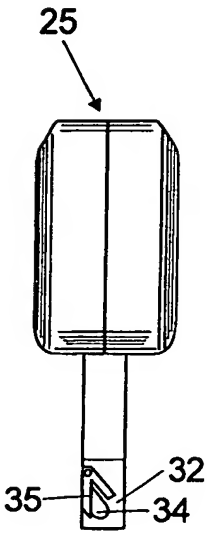


Fig 6

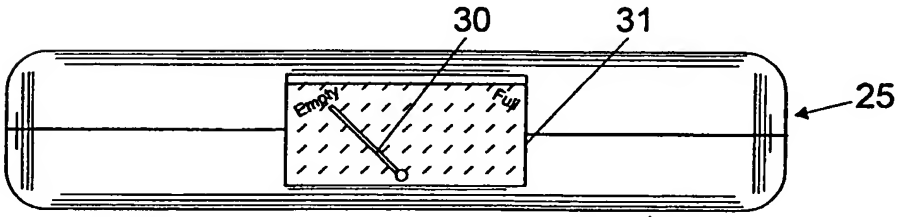


Fig 7

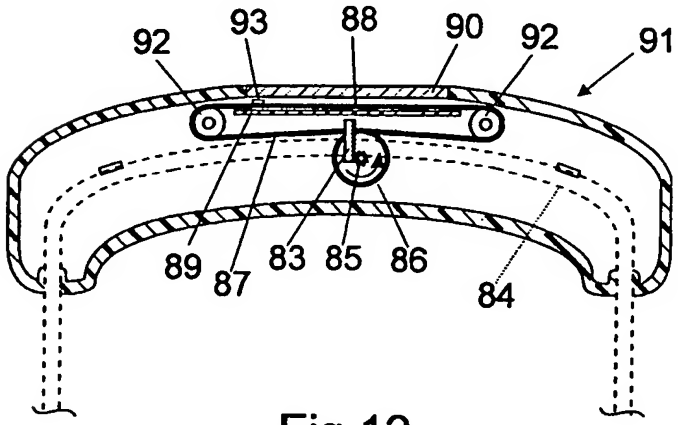


Fig 12

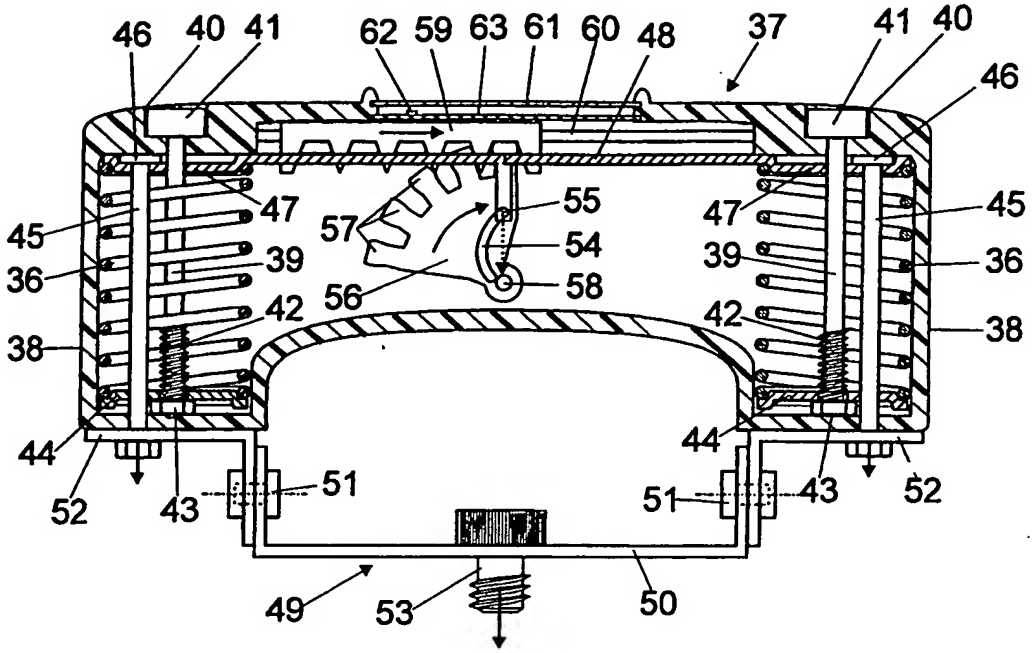


Fig 8

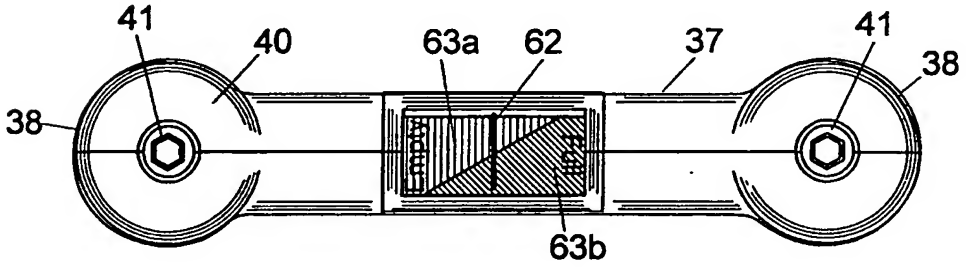


Fig 9

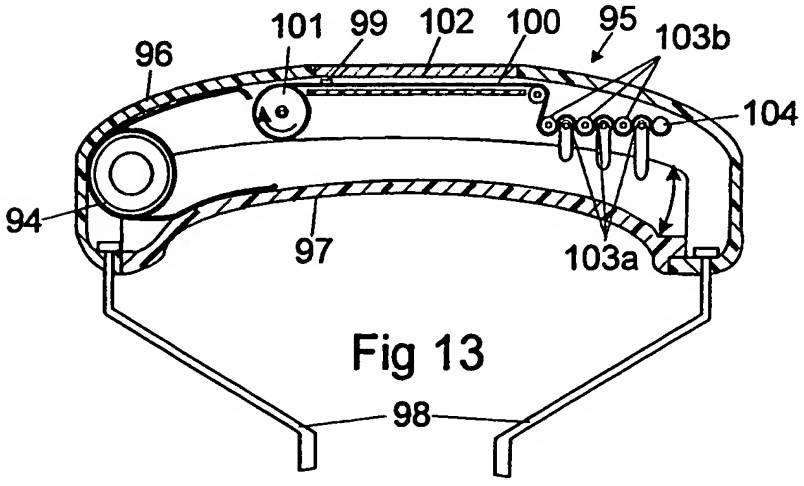


Fig 13

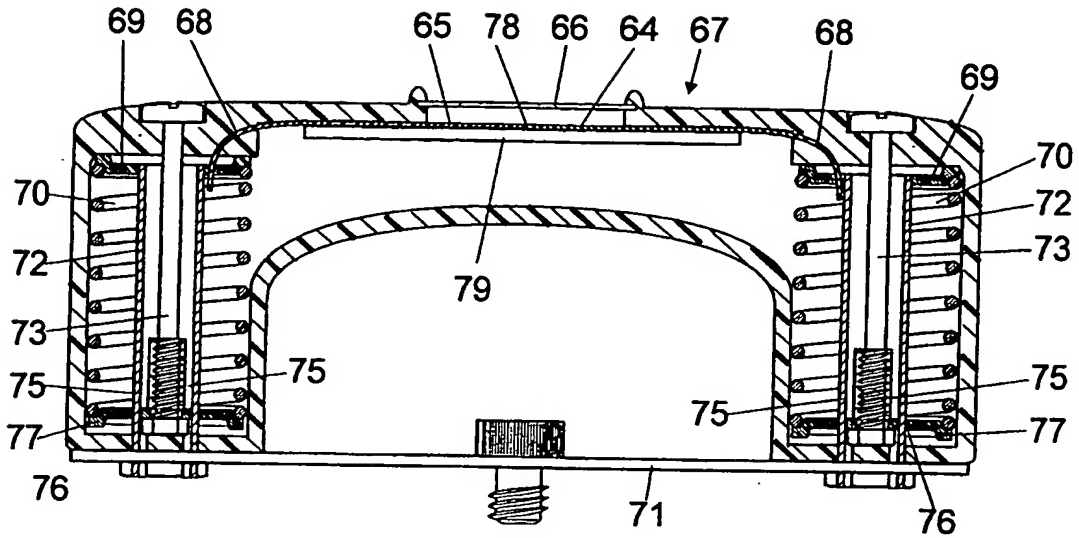


Fig 10

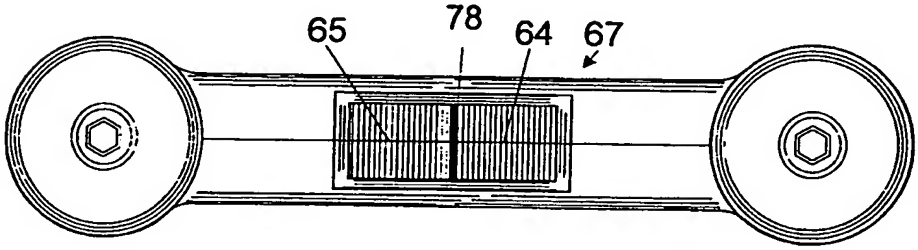


Fig 11a

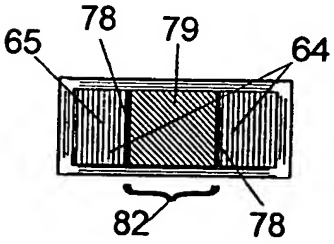


Fig 11b

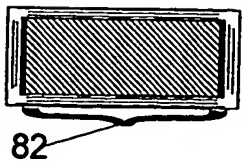


Fig 11c

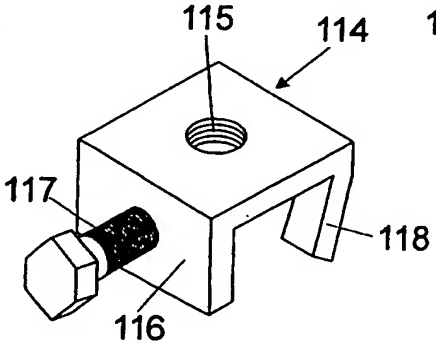


Fig 17

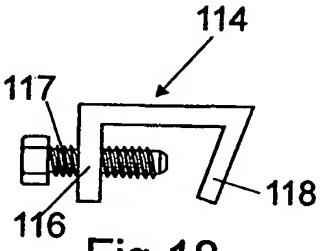


Fig 18

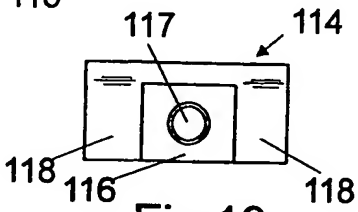


Fig 19

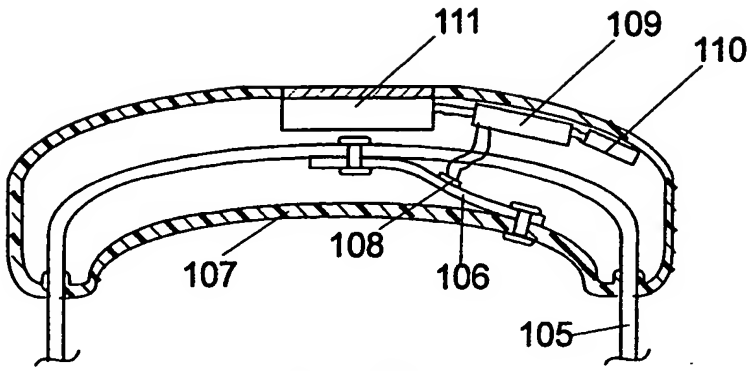


Fig 14

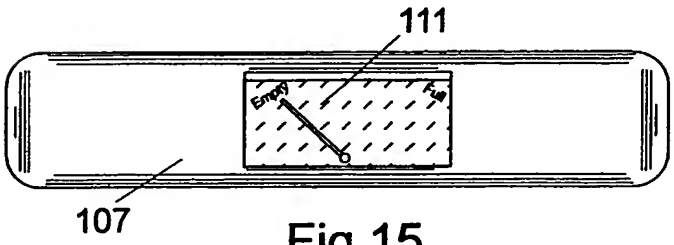


Fig 15

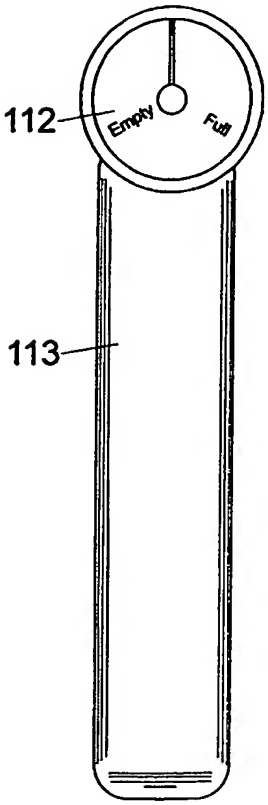


Fig 16

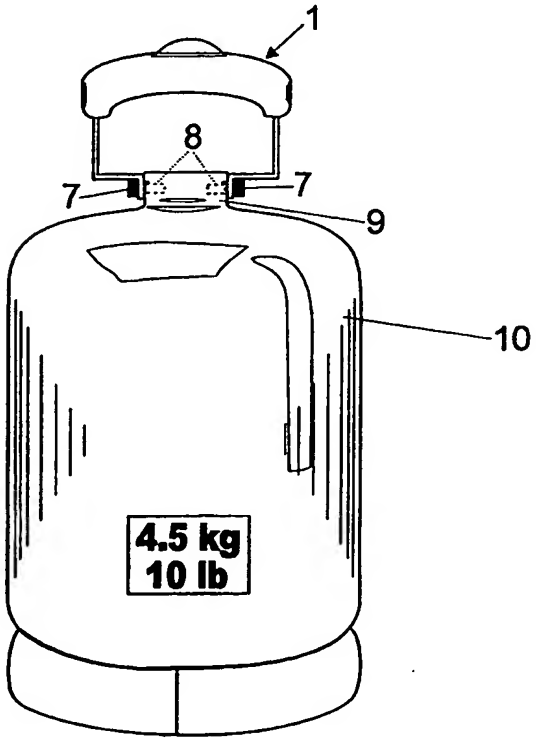


Fig 20

INTERNATIONAL SEARCH REPORT

In ational Application No
PCT/ZW 98/00007

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G01G19/58 G01G17/04 F17C13/02 A45C13/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G01G F17C A45C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 20 60 208 A (KOLLER H) 15 June 1972 see the whole document	1-6,15
Y		9,17
Y	FR 2 193 198 A (ROQUES LOUIS) 15 February 1974 see figure 1	9
X	US 2 710 083 A (W.J.WHITE) 7 June 1955 see figure 1	1
Y	CH 183 251 A (M.BETZLER) see page 1, left-hand column, paragraph 1	17
A	US 2 759 577 A (W.J.WHITE) 21 August 1956 see figure 1	1

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 December 1998	10/12/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Ganci, P

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

In ..ational Application No
PCT/ZW 98/00007

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 017, no. 645 (M-1517), 30 November 1993 & JP 05 203135 A (SAN FRONTIER TECHNOL:KK), 10 August 1993 see abstract -----	1,7

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

In. .ational Application No
PCT/ZW 98/00007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 2060208 A	15-06-1972	NONE	
FR 2193198 A	15-02-1974	NONE	
US 2710083 A	07-06-1955	NONE	
CH 183251 A		NONE	
US 2759577 A	21-08-1956	NONE	